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The Impact of Body Position on the Relationships Between Intra-Vaginal Dynamometry and Ultrasound Imaging Measures: A Retrospective Analysis

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INTRODUCTION

Pelvic floor assessments typically occur in **supine positions.**

However, pelvic floor symptoms are worse in **upright postures.**

Prior research on LAM driven vaginal closure forces has shown ***greater, smaller and equal*** forces in standing when compared with supine positions [1,2,3].

The aims of this study were to...

1. Evaluate whether body position impacts measures of LAM function.

2. Investigate the relationships between ultrasound and dynamometry measures of LAM function.

METHODS

Retrospective analysis of a concluded cross-sectional, observational study [4]

Inclusion Criteria:
- Assigned female at birth
- Prior instruction and practicing of LAM contractions for +3 weeks

Exclusion Criteria:
- Pregnant or <6 months postpartum
- Pelvic trauma history
- Dyspareunia
- POP >2 stage
- Surgery for POP or incontinence

1st Lab Visit - Mechatronic Intravaginal Dynamometer (IVD)

In both supine and standing: 3x rest trials + 3x maximum voluntary contractions (MVCs)

Measures: rest force, baseline force, peak force (PF), releative peak force (RPF), and rate of force development (RFD)

2nd Lab Visit - 2D Transperineal Ultrasound (USI)

In both positions: 3x dynamic MVC trials

Measures: levator plate length (LPL) and bladder neck height (BNH) at both baseline and at their peak during MVC.

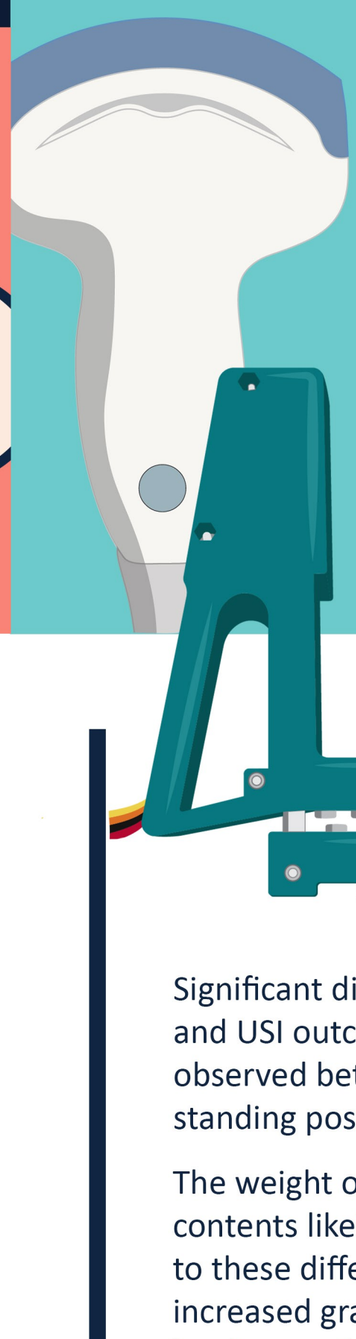
Analyses (SPSS v25):

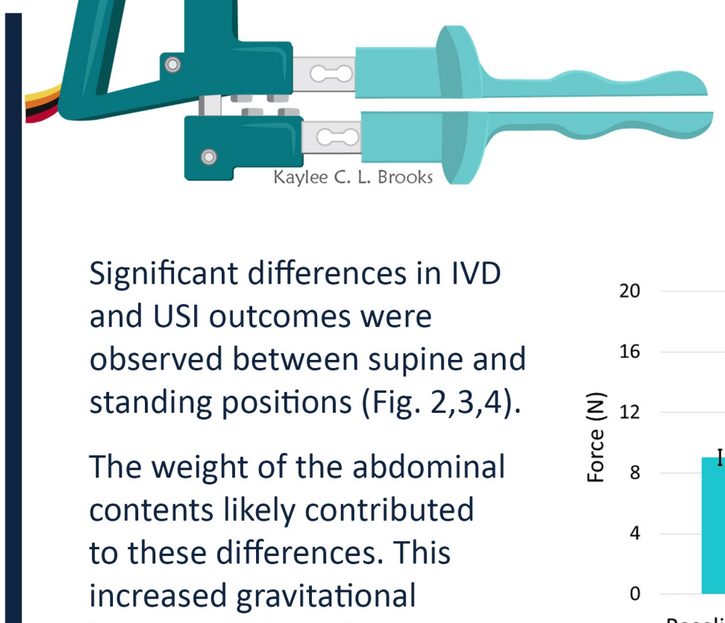
Medians calculated from 3 trials

Normality = Shapiro-Wilks

Supine vs. Standing = paired samples *t*-tests + 95% CIs

USI + IVD Relationships = multiple regression models with uncorrected significance





n = 26

- **42 +/- 2 years**
- **1.66 +/- 0.01 m**
- **70.40 +/- 2.38 kg**
- **22 (85%) parous**

ICIQ Modules

FLUTS	Filling	3 +/- 2
	Voiding	1 +/- 2
	Incontinence	4 +/- 3
BOWEL	Pattern	5 +/- 2
	Control	1 +/- 2
	QoL	2 +/- 4
VAGIN.	Symptoms	7 +/- 5
	Sexual Matters	6 +/- 9
	QoL	1 +/- 2

USI & IVD RELATIONSHIPS

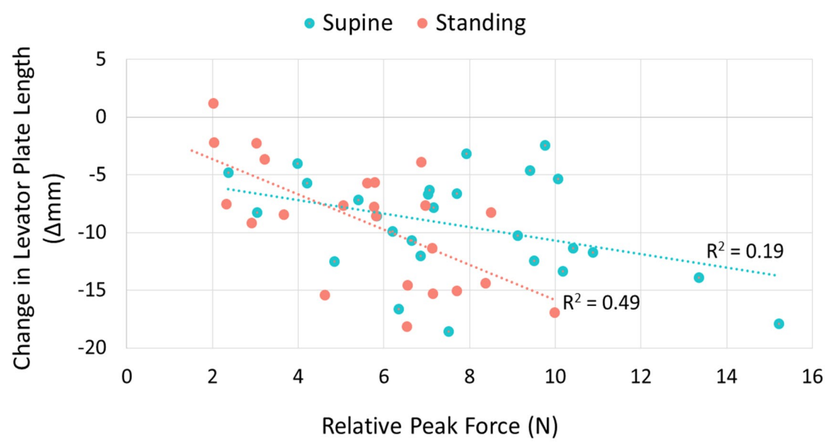


Fig. 1 The change in levator plate length (USI) versus the relative peak force (IVD) measured in supine and standing. While the model was significant in both body positions, the relationship was slightly stronger in standing.

The regression models showed a significant negative relationship between RPF measured through IVD and the change in LPL observed during LAM MVC in both supine (adj. R2 = 0.19, p = 0.05) and standing (adjusted R2 = 0.49, p = 0.00) (Fig. 1). While these relationships are significant, they explain less than half of the variance in each position. Additional variance may be explained through future work with a more diverse participant pool.

The lack of a significant relationship between bladder neck elevation and LAM force measured through IVD during contraction is not surprising. The position of the bladder neck within the pelvic cavity was defined in relation to a plane drawn between the pubic symphysis and the anorectal junction, whose position within the pelvic cavity can vary during contraction. As a result, we do not recommend change in BNH as an indirect measure of LAM contractile force.

IMPACT OF BODY POSITION

Significant differences in IVD and USI outcomes were observed between supine and standing positions (Fig. 2,3,4).

The weight of the abdominal contents likely contributed to these differences. This increased gravitational loading on the pelvic structures when in upright positions would result caudal displacement of the bladder and anorectal canal (Fig 3). This would, in turn, result in higher baseline forces measured by the IVD (Fig 2).

These differences are in line with previous work [2] and they continue to highlight the importance of assessing the morphology and function of the pelvic floor in upright positions.

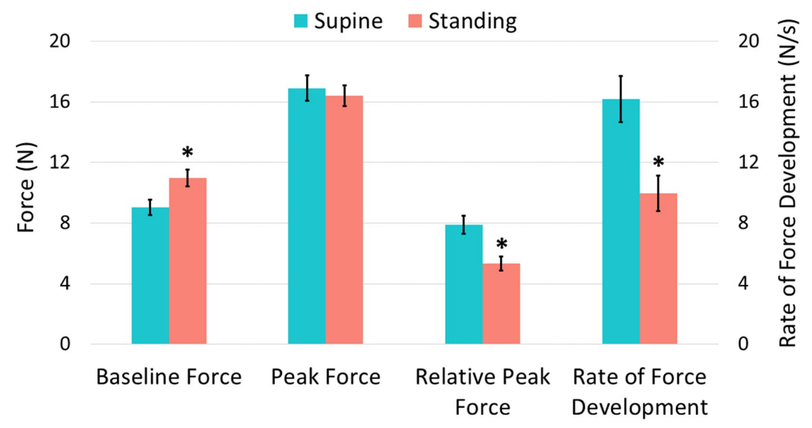


Fig. 2 IVD forces and rate of force development measured in supine and standing. Baseline, relative peak forces and rate of force development were significantly different (α = 0.05) between body positions (*).

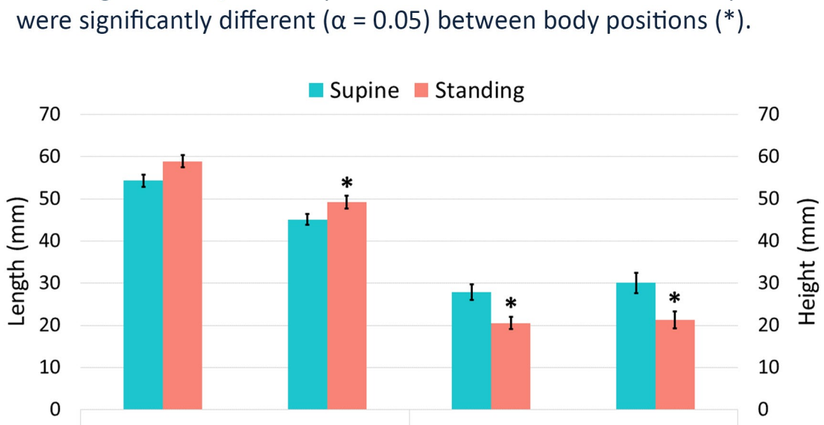


Fig. 3 USI levator plate length and bladder neck height meausred in supine and standing. Bladder neck height at baselineand peak as well as levator plate length baselines were significantly different (α = 0.05) between body positions (*).

Fig. 4 USI change in levator plate length and bladder neck elevation measured during MVCs in supine and standing. No significant differences (α = 0.05) were seen between body positions.

CONCLUSION & NEXT STEPS

LAM function assessed through both ultrasound imaging and intra-vaginal dynamometry differs between supine and standing body positions. Further, the established relationship between changes in morphology and intravaginal forces is stronger in standing compared to supine. These results highlight the importance of assessing pelvic morphology and function in a standing position.

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[1] Morgan et al. Am. J. Obstet. Gynecol. 195 (2005) 1722-1728.
[2] Frawley et al. Int. Urogynecol. J. 17 (2006) 365-371.
[3] Bø & Finckenhagen. Acta Obstet. Gynecol. Scand. 82 (2003) 1120-1124.
[4] Czyrnyj et al (2020) Neurourol. Urodyn. 39; 1717-1731